Software Product Line Engineering

Processes, Business, Technology, Architecture and Organizations

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Teachers et al.

Richard Torkar



- Former officer in the Swedish Army
- BSc from University West, PhD in Software Engineering from Blekinge Institute of Technology (BTH)
- Currently: Associate Professor at BTH
- Consultant for >8 years (Ericsson, Sauer-Danfoss, SonyEricsson etc.)
- CTO for one company (later sold)
- Fly fishing. 2 kids. One wife (only one so far)

Robert Feldt (examiner)



- MSc CS&E 1997, PhD 2002 Software Eng.
- Currently: Associate Professor BTH & Chalmers
- Consultant >14 years (Stena, Mobitec, Mimer etc)
- CTO 1 company, 1 AI Startup
- Currently: IPhone apps, Ruby, Clojure, C
- Before: Java, C++, Haskell, ML, MC68k assembler, ...
- Golf, 2 children (4&8 years), Wine

Tony Gorschek



- B.Sc. BA, M.Sc. CS, PhD Software Engineering
- Entrepreneurial work
- Consultant >10 years (IBM, IM, IMI, ABB, DHR, Ericsson, Lexicon, EDB, etc)
- CTO 3 companies
- Currently: Associate Processor BTH, Assistant Professor Chalmers, Consultant DocEngineering
- Single malt (>12y), German cars, B&W 803D

Martin Ivarsson



- PhD student at CTH.
- And...

How to reach us?

- Email rules!
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What is SPL?

- Software Product Line = Set of software products
  - with common features,
  - but each different.
- Individual products built from reusable/configurable assets
- Product line targets specific market/segment

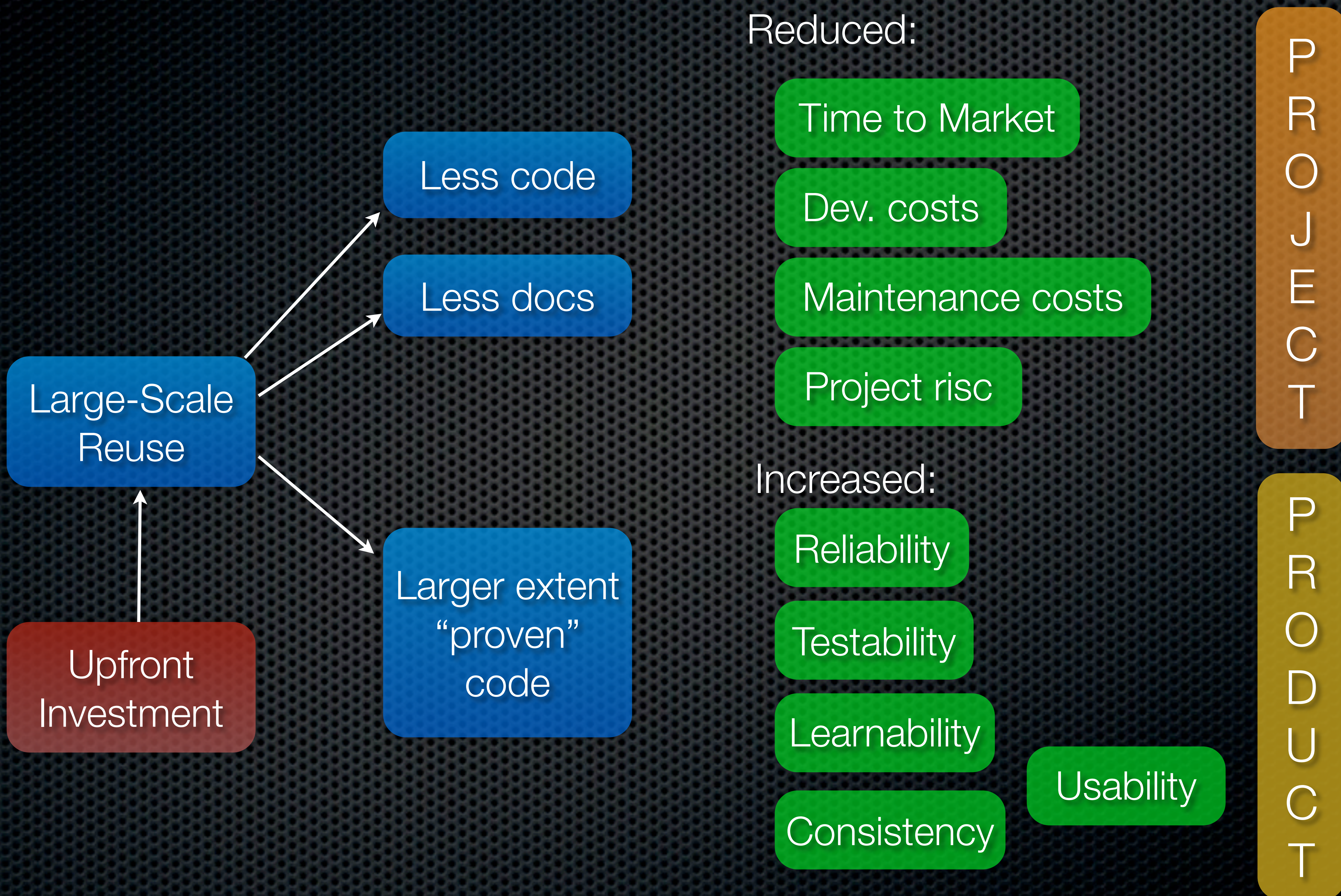
What is SPLE?

- Planned approach to Large-Scale Reuse
  - Line of Multiple Products, instead of
  - Individual software system
- Domain and Application Engineering
  - DE: Extract commonality for a domain/area
  - AE: Build multiple apps in a domain

Dev ***for*** reuse

Dev ***with*** reuse

Why SPLE?


Reduced:
Time to Market
Dev. costs
Maintenance costs
Project risc
Increased:
Reliability
Testability
Learnability
Consistency
Usability
PROJECT
PRODUCT
Less code
Less docs
Larger extent "proven" code
Large-Scale Reuse
Upfront Investment

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Course Structure

- Lectures (RT & TG mostly)
- Support/Feedback sessions (MI & RT & TG mostly)
- Assignment - Industry Case Study (TG mostly)
- Written exam (RF mostly)

Examination

- 2 parts:
  - Assignment: 40p, groups of 4, 12-15 pages IEEE
  - Written exam: 60p, Individual
- Grades:

Point total	CTH
<50	Fail
50-66	3
67-84	4
85-100	5

Point total	ECTS
<50	Fail
50-59	E
60-69	D
70-79	C
80-89	B
90-100	A

You need at least 50% points on both exam and assignment!

Written Exam

- Mix of:
  - simpler / fact-based questions,
  - practical, technical questions, and
  - larger, essay-like problem solving / evaluation questions.
- Based on SPLE book + lecture material
- Will take place Dec. 17 (afternoon) (see Studieportal)

Assignment

- Industry Case Study, goals:
  - Practical, real-world SPL experience
  - Closer connection to relevant companies
  - Research experience - mini study
- Major part of course
  - You need to put in lots of effort!
  - Support and feedback from us continuously
  - Companies that commit will want something useful back

Assignment - basics

- Group assignment - groups of 4 assigned by teachers (next lesson)
- Format:
  - IEEE Conference Proceedings template (use LaTeX, it'll save you some time in the future...)
  - 12-15 pages + Appendix + References
  - >= 15 peer-reviewed references
- Submission in 3 steps (hard deadlines):
  - 091121 12:00: Company info e-mail to Tony Gorschek
  - 091128 12:00: Case study design e-mailed to Tony Gorschek
  - 100108 09:00: Complete Assignment Report as PDF e-mailed to Robert Feldt (robert.feldt@gmail.com)

Assignment - grading

- A total of 40 points on assignment:
  - max 32 points for assignment report,
  - max 5 points for presentation,
  - max 3 points for opposition.

Assignment - presentation

- Present your findings for rest of class + teachers
  - 090115, schedule distributed later
- 15 min presentation + 15 min questions/discussion
  - Questions from opponents + teachers

Do's:	Dont's:
Focus on essential info/findings	Spend time on basic/general info
Audience sees the screen	Stand in front of screen
Explain diagrams, figs & graphs	Point to computer screen
Start with main results, limit yourself!	Dense slides with lots of text

Assignment - SPL Assessment & Improv.

- 1. Find a product dev company - get them to commit
- 2. Plan & design case study
  - BAPO or PLPA as basis for assessment
  - Expand with more questions as you see fit
- 3. Conduct case study - benchmark current processes
  - Typically: Interviews + document analysis => state-of-practice
- 4. Compare state-of-practice to state-of-the-art
  - As found in course contents & peer-reviewed sources
- 5. Analyze & propose improvements

Approaching Companies How-to

- Find potential companies from press, job offerings, web search, yellow pages etc
  - Google for good, logical contact persons
- Call by telephone - mail does not work believe me...
- If you hit switchboard
  - Present yourself (Sven Svensson, calling from Chalmers)
  - Best if you have name already, ask for them or ask for logical choice (project manager)

Approaching Companies How-to 2

- Once you reach a person
  - Introduce yourself: “Hello my name is X X, I’m a student at Chalmers, can you spare 5 minutes?”
  - Explain that you are doing a case study where industry input is important.
  - This is a part of a SPLE course (drop our names if you feel it would help make it more official).
  - BEFORE you go into what you need, explain benefit for them
    - “We are performing a **process assessment** as a part of the course. The **benefit** for you is that we will deliver a report to you with our findings which have been **quality assured** through the course... All things are completely **anonymous**, and your company will be anonymized in our reports... but this should not be a problem as the purpose is to find **possibilities for improvement** and this is nothing negative”

Approaching Companies How-to 3

- If everything goes well you will come to what you need.
  - Start by booking one meeting (say 45min).
  - Then during that meeting (see it as a preparation meeting) you discuss the possibilities for access and what you need.
  - Don’t start your call with "we need 3 interviews and access to process documentation", rather start lightly with a 45 min meeting and go from there.
  - Build confidence during this conversation. At any time you might be interrupted by the person saying that (s)he is not the correct person to talk to... then you very nicely ask for a referral (get the persons full name and contact info). Say thank you and call the new/other person.

Approaching Companies How-to 4

- Now here is the key, when you call the new person, you present yourself and tell that you were referred by X. Start over.
- Prep meeting:
  - Once you are in this meeting everything is easier
    - Dress nicely
    - Drop names: “As a part of the SPLE course we are contacting several companies, such as Ericsson, ABB, Volvo etc, to learn from them, and to recommend possibilities for improvement.”
    - If company wants to or have trouble trusting you they can contact anyone of us

Approaching Companies How-to 5

- During the meeting
  - offer to sign a NDA if they want (example on course home page)
  - Reassure them again that all results will be anonymized, and if they still are skeptical, offer them to read your report before you are allowed to submit it.

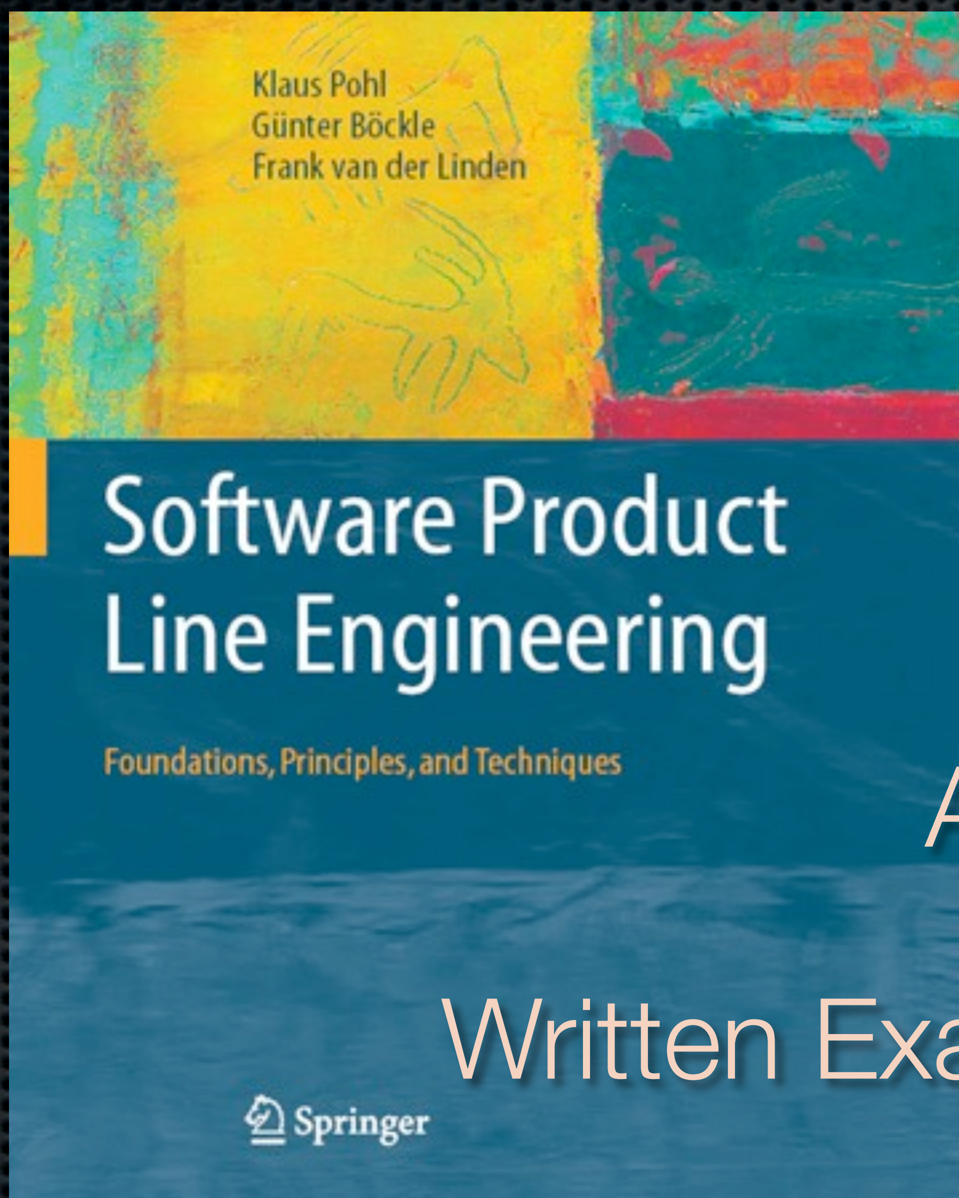
What we will expect from you

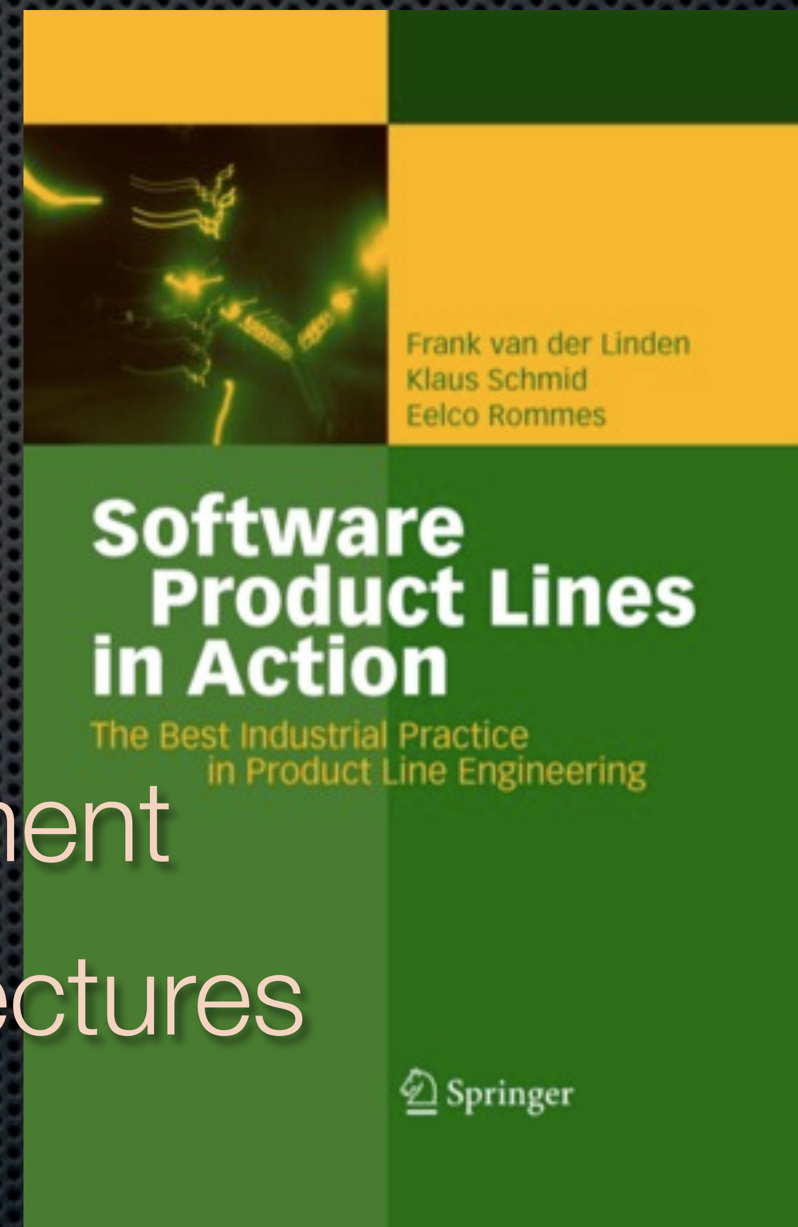
- Read books, go to lectures, question/be active
- Check course home page, read all material
- “Own” your assignment project
  - You have got to drive it!
  - You have got to start early! Now!
  - Read the description in depth!
  - All group members should contribute; we will evaluate this
- Follow advise and rules!
- Ask if anything unclear

Course home page

- We have our own course home page:
  - http://trind.dyndns.org/~feldt/cth/sple/
- We expect you to check it **often**!
- Especially on mornings before course activities

Books





Assignment

Lectures

Written Exam

SPLE

SPLIA

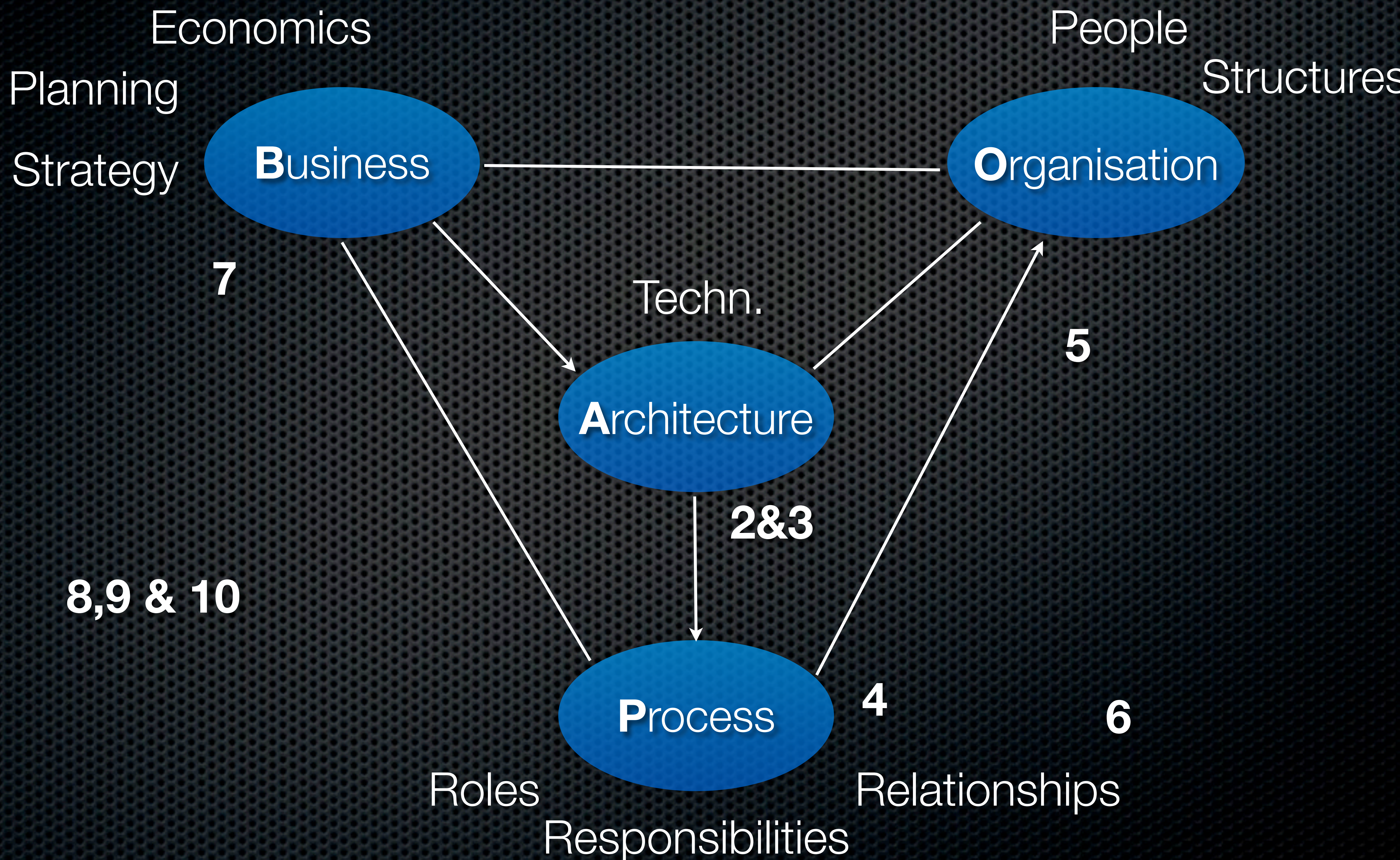
Lectures - Philosophy

- “Book” learning is fine - but direct experience is better
  - Focus on lectures and “book” reading early
  - Focus on assignment and “real-world” later

BAPO - Software Dev Concerns

- **B**usiness - how to make money from products
- **A**rchitecture - technical means to build sw
- **P**rocess - roles/responsibilities/relationsships in sw dev
- **O**rganisation - mapping roles to org structures

Lectures - Overview (BAPO Model)



L2: Variability & Architecture

- Introduction to Variability and Variability Management
  - Motivation
  - Realising variability - adaptation, replacement & extension
- Reference architecture
  - Creation & Variation points
- Architecture concerns
- Experiences from industry

L3: Variability, scoping & domain analysis

- Concrete variation mechanisms
  - Inheritance, Patching, Compile-time config, Configuration, Code generation, Component replacement, Plug-ins
- Domain design & realization
- Ref Architecture Evolution
- Experiences from industry

L4:Processes and SPL

- Introduction to Processes
- Process in Product Line Engineering
    - SPL Engineering framework(s) (Domain and Application Engineering sub-process areas)
        - RE, Analysis&Design, Development, V&V, Project management, Configuration Management
    - Coordination, predictability (planning and resources)
    - Control vs. Agility
    - Experiences from industry

L5: Processes and Organizational Issues

- Process in Product Line Engineering
  - Roles and Responsibilities
  - Organizational Structures (orientation, pros and cons)
  - Product Management (incl. Market-driven product development)
  - Global Product Development
  - Experiences from industry

L6: SPA/SPI

- Introduction to Process Assessment and Improvement
  - Inductive vs. Prescriptive (examples from QIP and CMMI)
  - Measurement (e.g. ROI, GQM)
  - Process Assessment (incl. triangulation)
    - Challenges and experience form industry
    - How to do it... examples (case study relevant)
      - QnA w.r.t. case study assessment

L7: Business Issues for SPL

- Business / Markets / Strategies
  - What is the point?
  - Company and Product Strategies
  - Product Line Economics
  - Product Management and Portfolio Management
  - Tools (GAP, IVA, CVA...)
- How to create usable strategies
- Examples from industry...

L8: Transitioning to SPL

- Concerns in deciding to go SPLE
  - Market drivers, Technical factors
- Product Line Potential
  - Essential, Supporting and Exclusion Criteria
- Organizational change in general - SPL change in particular
- Big bang vs Incremental, Extractive vs Proactive
- Different transitioning strategies
  - Lessons learned in industry

L9: Transitioning, FEF, Domain & App Eng

- More on Transitioning to SPLs
- Evaluating SPL with the FEF (Family Evaluation Framework)
- Domain and Application Engineering revisited
- Extra as needed

L10: Testing and SPL, Challenges

- Testing in SPL
  - Reusing tests
- Challenges with SPL
- Recent research results (SPLC)
- Extra as needed

SPL vision shares resemblance with (Ford) Production Lines

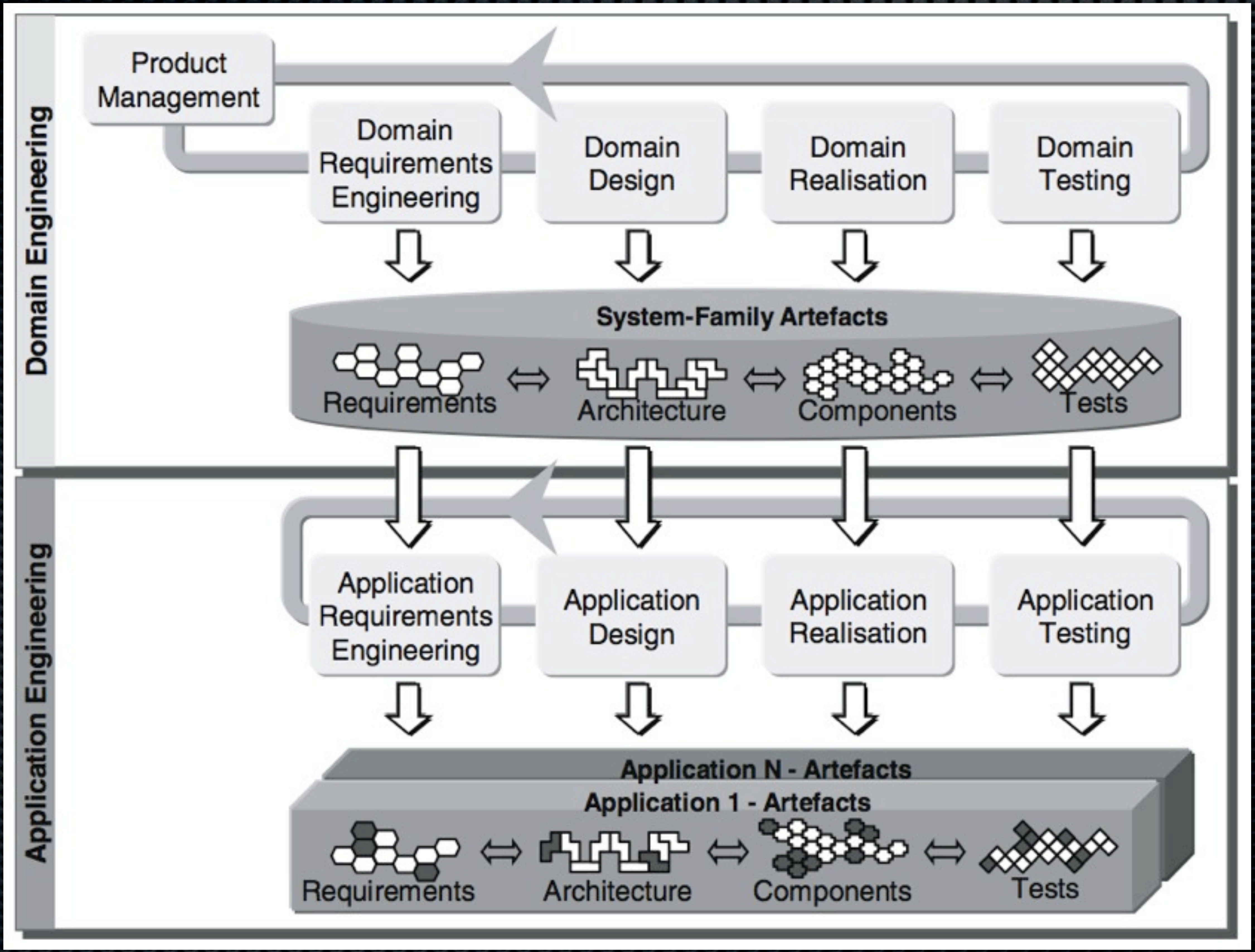


Customers want different products => Mass customisation => Common Platforms

Platform

- Platform = any base of technologies on which other technologies or processes are built
- Examples:
  - Post-it notes platform for company post-its, book markers etc
  - Canon DSLR cameras - all based on Digic I/II/III

Domain and Application Engineering



Acronyms used

- SW = Software
- SPL = Software Product Line
- SPLE = SPL Engineering (and course book!)
- Dev = Development